DOCUMENT RESUME

ED 394 888 SO 026 290

AUTHOR Gallop, Nancy
TITLE Science Is Women's Work: Photos and Biographies of American Women in the Sciences.
INSTITUTION National Women's History Project, Windsor, CA.
REPORT NO ISBN-0-938625-41-1
PUB DATE 94
NOTE 67p.
AVAILABLE FROM National Women's History Project, 7738 Bell Road, Windsor, CA 95492.
PUB TYPE Guides - Classroom Use - Instructional Materials (For Learner) (051) -- Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Biographies; Elementary Secondary Education; *Females; Science Education; *Sciences; Social Studies; *Womens Studies
IDENTIFIERS *Women in Science

ABSTRACT

Girls show an early interest in science, but are deterred from pursuing science careers as they get older due to society's stereotypes. This text identifies the many women in history who have made significant contributions to all scientific fields. The volume features the biographies of Maria Mitchell (Astronomer); Ellen Richards (Chemist, Ecologist); Ida Hyde (Physiologist); Florence Bascom (Geologist); Annie Cannon (Astronomer); Lillian Gilbreth (Industrial Engineer); Anna Wheeler (Mathematician); Leta Hollingworth (Educational Psychologist); Olive Hazlett (Mathematician); Margaret Mead (Anthropologist); Barbara McClintock (Geneticist); Grace Hopper (Mathematician); Maria Mayer (Nuclear Physicist); Rachel Carson (Marine Biologist); Rita Levi-Montalcini (Biologist); Chien-Shiung Wu (Nuclear Physicist); Gertrude Elion (Pharmacologist); Rosalyn Yalow (Research Nuclear Physicist); Jewel Cobb (Biologist); Dian Fossey (Primatologist); Reatha King (Chemist); Shirley Jackson (Theoretical Physicist); Lydia Villa-Komaroff (Molecular Biologist); Edna Paisano (Statistician); Constance Noguchi (Physical Biochemist); and Judith Resnik (Electrical Engineer). A 16-item list of additional resources pertaining to women in science concludes the book. (JAG)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 394 888

Science is Women's Work

Photos and Biographies of American Women in the Sciences

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
X This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY
Lisa Smith
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

SO 026 290

National Women's History Project

 BEST COPY AVAILABLE

Science is Women's Work

Photos and Biographies of American Women in the Sciences

Written by Nancy Gallop
for the
National Women's History Project

Conceived and developed by:
National Women's History Project
7738 Bell Road
Windsor, CA 95492
707-838-6000

© 1993 National Women's History Project
Revised 8/94
ISBN 0-938625-41-1

Foreword

Although many young children – girls and boys – show an early interest in science, that interest is often dampened by the time they reach high school. Girls especially seem to get the message from teachers, textbooks, and peers that science is not an appropriate occupation or interest for women. The women featured in this booklet have been able, in one way or another, to overcome any negative messages they may have received as children, to pursue their interests in science and mathematics.

As you read these biographies, you may notice that many of those who lived in the 19th or early 20th centuries attended and/or taught at women's colleges – Bryn Mawr, Vassar, Mount Holyoke, Radcliffe, Sarah Lawrence, Wellesley, Smith, and Barnard. At these schools, and others like them, women students found the support, encouragement and role models they needed to pursue the rigorous academic training necessary for a professional career in mathematics or science. It is our hope that the lives of these women will similarly inspire future generations of scientists and mathematicians.

Acknowledgements

These biographies were researched and written by Nancy Gallop for the National Women's History Project. Editorial assistance was provided by Bonnie Eisenberg and Mary Ruthsdotter. Extensive photo research was conducted by Susanne Otteman. Cover art is by S. Dmitri Lipczenko, from the "Celebrate Women!" poster. Many thanks to our friends at the Math-Science Network in Oakland, California: the EQUALS Project at U.C. Berkeley; Janice Koch, science education specialist at Hofstra University; and the Association of Women in Mathematics for helping us select the women to be included.

Resources

Many of the women in this booklet also appear on the "Women in Science and Mathematics" poster, distributed by the National Women's History Project. The eye-catching and colorful poster features twenty historic and contemporary women mathematicians and scientists. Also available from the NWHP is the "Outstanding Women in Mathematics and Science" photo display which features many of the same photographs in this booklet, and short biographies written at a higher reading level, suitable for grades seven-adult. Many other resources on women in scientific and mathematical careers – including biographies, reference books, and videos – are also available through the Women's History Catalog. For a free copy of the 48-page Women's History Catalog, please write to: National Women's History Project, Science Dept., 7738 Bell Road, Windsor; CA 95492. Or call 707-838-6000.

Science is Women's Work

Table of Contents

Maria Mitchell (1818-1889) Astronomer 5
Ellen Swallow Richards (1842-1911) Chemist, Ecologist 7
Ida Hyde (1857-1945) Physiologist 9
Florence Bascom (1862-1945) Geologist 11
Annie Jump Cannon (1863-1941) Astronomer 13
Lillian Moller Gilbreth (1878-1972) Industrial Engineer 15
Anna Pell Wheeler (1883-1966) Mathematician 17
Leta Stetter Hollingworth (1886-1939) Educational Psychologist 19
Olive C. Hazlett (1890-1974) Mathematician 21
Margaret Mead (1901-1978) Cultural Anthropologist, Author 23
Barbara McClintock (1902-1992) Geneticist 25
Grace Murray Hopper (1906-1992) Mathematician 27
Maria Goeppert Mayer (1906-1972) Nuclear Physicist 29
Rachel Carson (1907-1964) Marine Biologist, Author 31
Rita Levi-Montalcini (b. 1909) Biologist 33
Chien-Shiung Wu (b. 1912) Nuclear Physicist 35
Gertrude B. Elion (b. 1918) Pharmacologist 37
Rosalyn Sussman Yalow (b. 1921) Research Nuclear Physicist 39
Jewel Plummer Cobb (b. 1924) Biologist 41
Dian Fossey (1932-1985) Primatologist 43
Reatha Clark King (b. 1938) Chemist, Administrator 45
Shirley A. Jackson (b. 1946) Theoretical Physicist 47
Lydia Villa-Komaroff (b. 1947) Molecular Biologist 49
Edna Lee Paisano (b. 1948) Statistician 51
Constance Tom Noguchi (b. 1948) Physical Biochemist 53
Judith Resnik (1949-1986) Electrical Engineer, Astronaut 55

Maria Mitchell (1818-1889)
Astronomer

BEST COPY AVAILABLE

Photo courtesy: Vassar College Library

MARIA MITCHELL (1818 - 1889)
Astronomer

Nearly every evening after dinner, Maria Mitchell's father took his children up to the roof of their house. There they could see a spectacular show – the sky filled with stars, planets, and the moon. Maria could not have imagined then that one day a crater on the moon's surface would be named after her.

When she was young, Maria learned how to operate a reflecting telescope and how to count seconds by using a chronometer. Even as a child she was able to test the accuracy of the navigational instruments used on the whaling ships sailing in and out of her hometown, Nantucket, Massachusetts.

In 1836 Maria became librarian of the Nantucket Library, where she worked for the next 20 years. She spent her evenings stargazing with her father from their rooftop observatory. Together they logged thousands of accurate observations. Their work was recognized by the United States Coast Survey and the Harvard Observatory.

But it was recognition by the king of Denmark that brought Maria Mitchell international fame. In 1847 she was the first person in the world to discover a comet by using a Danish telescope. For this accomplishment she was awarded a medal from the king.

When Vassar College was founded as a school for women in 1865, Maria Mitchell was invited to join the faculty as professor of astronomy and director of the college observatory. She was promised a 12-inch telescope for the observatory. That promise convinced her to take the job because it would be the third largest telescope in the entire country.

During the 23 years she taught at Vassar, Maria Mitchell had a strong influence on many of the women students in her astronomy classes. Twenty-five of Maria Mitchell's students were listed in *Who's Who in America* for their scientific accomplishments.

Maria Mitchell grew up in an era when few women had careers and even fewer had careers in science. She often observed, "How much women need exact science." After years of working in the field, Maria came to another conclusion, observing, "How much science needs women."

Ellen Swallow Richards (1842-1911)
Chemist/Ecologist

BEST COPY AVAILABLE

Photo courtesy: The Massachusetts Institute of Technology Museum

ELLEN SWALLOW RICHARDS (1842 - 1911)
Chemist, Ecologist

Today Ellen Swallow Richards is often called the founder of ecology. But in *her* day, women were expected to confine their interests to their own households. So Ellen called her scientific work "oekology" from the Greek word for "household." To Ellen her household included everything from air and water quality to public health, nutrition, and consumer protection.

To earn money to study chemistry at Vassar, a new college for women, Ellen worked as a cook and nurse. After receiving an undergraduate degree from Vassar in 1870, Richards persuaded the newly founded Massachusetts Institute of Technology (MIT) to accept her as a "special student" in chemistry. She was "special" because women had not previously been allowed to attend the college. She was the first MIT student to complete the course work for a Ph.D., but she was not officially given the degree because the university wanted the first doctorate in science to go to a man. She was then hired by MIT and taught chemistry there for 34 years.

Early in her career, Ellen Swallow Richards analyzed water and sewage systems for the Massachusetts Board of Health. Her work helped to set statewide water quality standards. It also established her reputation as a water scientist. Richards saw that, as the country became more industrialized, new problems were developing. Some of these problems were polluted air and water, impure food products and poor public health.

Richards helped form a number of organizations and laboratories to address these problems. She founded the American Home Economics Association, the New England Kitchen, the Women's Science and Sanitary Service Laboratories at MIT, and the Marine Biological Laboratory at Woods Hole, Massachusetts. She also helped found the American Association of University Women.

Ellen Swallow Richards often used her own kitchen to test food and consumer products. In fact, she made her entire home into a laboratory. She was one of the first to use such "high-tech" devices as a telephone, vacuum cleaner, hot-water heater, shower, and natural gas for cooking.

Ellen Swallow Richards' concern for the quality of life was ahead of her time. For this reason she was not taken very seriously by her male colleagues. But her vision drew attention to a subject taken very seriously today – ecology.

Ida Hyde (1857-1945)
Physiologist

BEST COPY AVAILABLE

 Photo courtesy: Kenneth Spencer Research Library, Univ. of Kansas

IDA HENRIETTA HYDE (1857 - 1945)
Physiologist

It was 1873, and well-brought-up young ladies of 16 didn't do paid work. But Ida Hyde had to. Her mother, brother and sisters needed her income after the Chicago Fire of 1870 destroyed her mother's business. As she left the house each morning, Ida covered her face with a scarf to avoid the embarrassment of being seen by her friends as she went to her factory job.

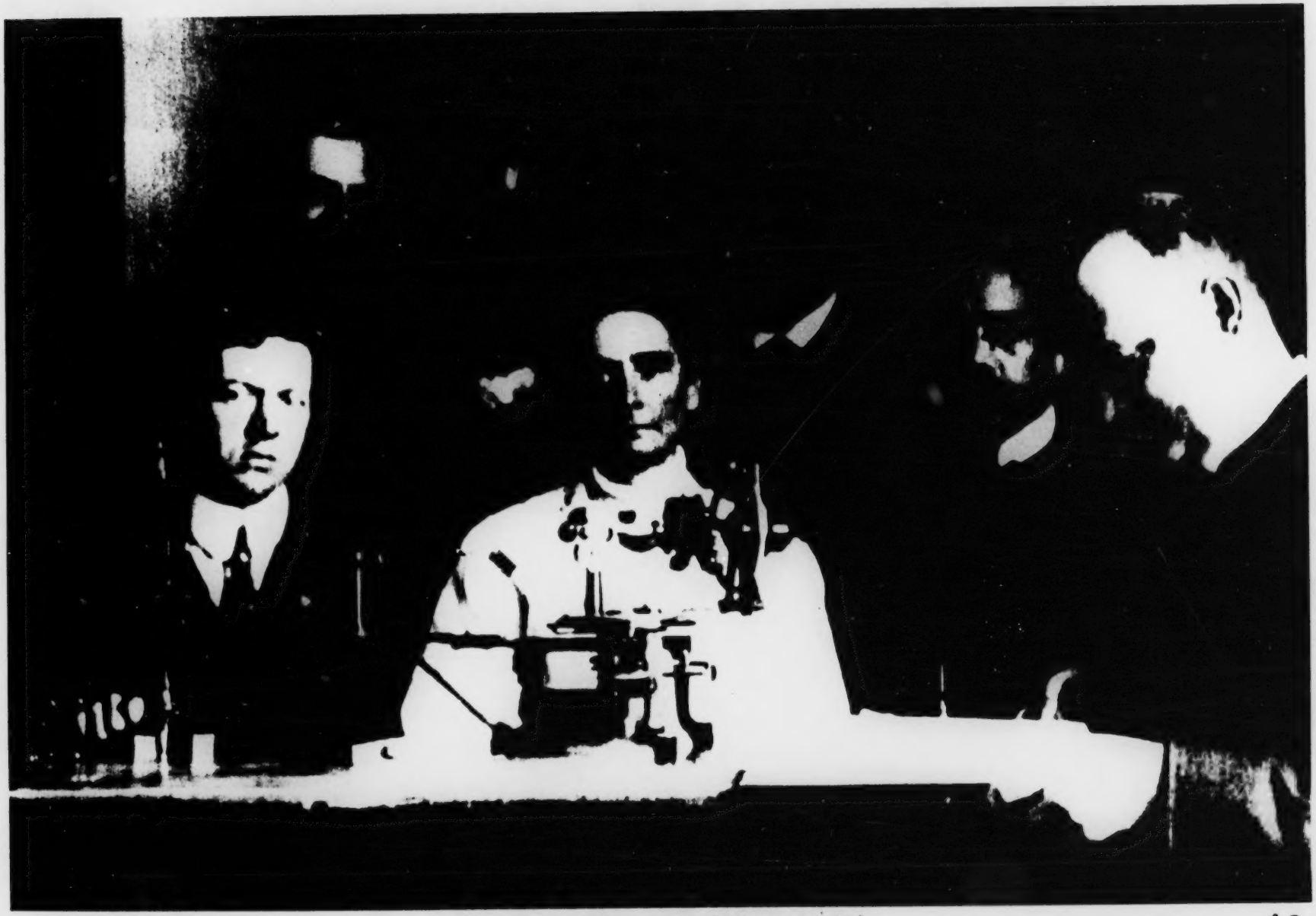
At the factory, Ida discovered a book about natural science tucked away in an old packing box and began reading it during her lunch hours. She became fascinated and determined to get an education. She even began attending night school after work.

Despite the family's hard times, Ida's brother was able to attend the University of Illinois. Ida longed for the same opportunity. She even took her case to the president of the university when she met him at her brother's graduation. At age 24, Ida Hyde was finally able to begin her college education. She earned a bachelor's degree in biological science from Cornell University. She then moved to Bryn Mawr College. There her experiments in physiology attracted interest and earned her an invitation to study and work in Germany. Ida Hyde completed a Ph.D. at the University of Heidelberg.

During those years there was strong prejudice against women in science. Dr. Ida Hyde once wrote a humorous account of her experiences entitled, "Before Women Were Human Beings." But while she could laugh at this situation she also took serious action. Ida Hyde was active throughout her life to gain equal opportunities for women in science.

Early in her career Dr. Hyde had worked at the well-known Marine Biological Laboratory at Woods Hole, Massachusetts. Later she became the first woman to do research at the Harvard Medical School. In 1898 she began teaching at the University of Kansas. As a professor and faculty member of the School of Medicine, she earned a reputation as a "gifted and stimulating teacher." She worked there for 22 years.

Dr. Ida Hyde's major contribution as a physiologist was her invention in 1921 of the microelectrode that revolutionized neurophysiology. Her contribution as a feminist was in making women more welcome in the scientific professions.



12

Florence Bascom (1862-1945)
Geologist

13

BEST COPY AVAILABLE

Photo courtesy: Sophia Smith College

FLORENCE BASCOM (1862 - 1945)
Geologist

The year was 1896, and a young woman rode through the mountains on horseback. She dismounted, picked up a rock and added it to the collection in her saddlebag. That winter she would examine her specimens under a microscope in her laboratory. The woman was Dr. Florence Bascom. She was doing field work as the first woman appointed as geological assistant with the U.S. Geological Survey. The USGS is the agency of the government that is responsible for mapping the country, and for researching its geological and water resources.

Florence Bascom achieved other firsts in her 61 years as a scientist, researcher, teacher and pioneer in geology. Her Ph.D. was the first awarded to a woman by Johns Hopkins University, where she had been seated behind a screen in class because women were not officially permitted to attend. In 1894 Bascom became the first woman elected a member of the Geological Society of America. And in her work, Florence Bascom was the first to prove that the rock formations in South Mountain, Maryland, were of volcanic origin rather than sedimentary as previously believed.

Bascom taught at Ohio State University for two years, then joined the faculty of Bryn Mawr College in 1895, where she advanced to full professor. Against opposition from the college president, she managed to establish geology as a major field of study at Bryn Mawr. At last, geology students had a graduate program, laboratory space, a mineral collection and equipment for research and instruction. Soon Bryn Mawr was recognized as a major center for the study of American geology.

Florence Bascom taught at Bryn Mawr for 33 years. She trained most of the women geologists of that period, greatly influencing the future of geological research in the United States.

After Florence Bascom died in 1945, her papers revealed that she believed that "...the fascination of any search after the truth lies not in the attainment but in the pursuit..." Perhaps she was recalling her early days, collecting rocks while horseback riding through the mountains.

Annie Jump Cannon (1863-1941)
Astronomer

Photo courtesy: Harvard College Observatory

ANNIE JUMP CANNON (1863 - 1941)
Astronomer

As a child, Annie Jump Cannon climbed up on the roof of her family's house in Dover, Delaware, to gaze at the stars. She was also fascinated by the way candlelight broke into rainbows as it shone through a crystal candleholder. Her curiosity about these things led her to become a scientist. Today Annie Jump Cannon is famous because, in her lifetime, she classified and catalogued more than 300,000 stars.

At 16, Annie was among the first young women from Delaware to attend college. She studied physics and astronomy at Wellesley, a women's college in Massachusetts. Her class took every opportunity to view the Great Comet of 1882. Annie also learned the new art of photography and traveled to Spain in 1892 to photograph the solar eclipse.

Two years later, Cannon returned to Wellesley to assist in the physics laboratory. She studied mathematics and advanced physics, and took courses in astronomy at nearby Radcliffe College. With her interest in stars, photography and light spectrums, she began to realize that she was a natural for a career in astronomy.

In 1896 Annie Jump Cannon joined the staff of the Harvard College Observatory, where she worked for more than 40 years. During her lifetime of studying spectrograms (specially made photographs of light), she became an expert at reading the stars' spectra. "They aren't just streaks to me," she said. "Each new spectrum is the gateway to a wonderful new world."

In 1911 Cannon was put in charge of all the astronomical photographs at the Harvard Observatory. The quantity and quality of her work was considered "amazing." She classified 5,000 stars a month and discovered 300 new variable stars. She also found five new "exploding" stars called novae. Astronomers still use the star-classifying system Cannon devised.

Although her biographers believe that Annie Jump Cannon did not get the full recognition she deserved, she did receive an honorary degree from Oxford University. In addition, the Royal Astronomical Society made her an honorary member, and the National Academy of Sciences awarded her a medal.

Lillian Moller Gilbreth (1878-1972)
Industrial Engineer

LILLIAN MOLLER GILBRETH (1878 - 1972)
Industrial Engineer

The creative ways Lillian Gilbreth managed her family of twelve children along with her career inspired her children to write a humorous book, *Cheaper by the Dozen.* Some of her methods for managing such a large family may have inspired laughter, but they worked. Together with her husband Frank, Lillian Gilbreth researched and developed much of what today is called industrial engineering. Her work won her more than twenty honorary degrees.

Lillian herself grew up in a large family in Oakland, California. She was very shy as a child. She learned to overcome her shyness when, at the age of twenty-two, she was chosen to give a speech when she graduated from the University of California at Berkeley. She was the first woman to be given that honor. She went on to earn a master's degree in literature and, later in her life, a Ph.D. in psychology.

After Lillian married Frank Gilbreth, the couple lived in New York, and she became a partner in her husband's business. As management consultants, Lillian and Frank Gilbreth watched the workers closely as they performed their tasks, to determine the best way to do various jobs. They then developed time-and-motion studies to help production workers be more efficient. The Gilbreth's book, *Psychology of Management*, became a classic in management theory.

After her husband's death, Lillian Gilbreth ran the business alone. At first the Gilbreth studies were designed to benefit factory owners by increasing the productivity of their employees. Later the studies were expanded to include workers' feelings, behavior, motivation and attitudes, to make the workplace better for them, too.

Using the results of her investigations, Lillian Gilbreth helped improve the modern workplace. She also applied her management techniques to homemaking, developing a model kitchen for people with disabilities. Foot-pedal trash cans and storage shelves on refrigerator doors were her ideas, too.

Gilbreth was also very active in her community, with the Girl Scouts and with organizations helping people with disabilities. She also held several government appointments during the 1930s and '40s. Throughout her life, Lillian Gilbreth lectured, taught as a college professor, and was an internationally known management consultant.

Anna Pell Wheeler (1883-1966)
Mathematician

Photo courtesy: Bryn Mawr College Archives

ANNA PELL WHEELER (1883 - 1966)
Mathematician

Before Anna Pell Wheeler was born, her parents lived in a house that was hollowed out from the side of a hill in Dakota Territory. They had come to the United States from Sweden and worked hard to make a living as farmers.

In 1899 Anna enrolled at the University of South Dakota. Her talent for mathematics was soon recognized by one of the professors there, Alexander Pell. He encouraged her studies and later he and Anna were married.

Anna won a scholarship to the University of Iowa. While a student there herself, she taught freshman mathematics. Then she won a scholarship from Radcliffe College, where she earned a master's degree. When she completed her Ph.D. in mathematics at the University of Chicago, she was only the second woman to earn a doctorate there.

When her husband suffered a stroke while teaching at the University of Chicago, Anna Pell took over teaching his classes. Her first full-time job was at Mount Holyoke College, a women's college in Massachusetts. She taught mathematics there, and took care of her husband, who never fully recovered from the stroke. In 1918, Anna moved to Bryn Mawr, another women's college, where she eventually became the head of the mathematics department. She taught there for 30 years, becoming well known as a fine teacher and the best woman mathematician of her time.

Anna Pell Wheeler worked hard to earn respect for women in science and mathematics. She encouraged her students and other female professors to do research and publish their work. She also encouraged them to play an active role in professional organizations. When Anna was listed in the 1921 edition of *American Men of Science*, a star was placed by her name. The star was to show that Wheeler was especially notable in her field.

In 1940, at the Women's Centennial, Dr. Anna Pell Wheeler was honored as one of the 100 women in America who had succeeded in careers not previously open to women. Even after she retired, Wheeler continued to be active in her field and to help other women with their careers.

Leta Stetter Hollingworth (1886-1939)
Educational Psychologist

Photo courtesy: Archives of the History of American Psychology, Univ. of Akron

LETA STETTER HOLLINGWORTH (1886 - 1939)
Educational Psychologist

As a child in school, Leta Stetter didn't believe everything she was told. She especially didn't believe that women weren't as smart as men because their bodies were designed for having children. It didn't make sense. Leta was one of the smartest students in her class! When she grew up, she used scientific research to disprove this old-fashioned idea about women.

Leta's father was a migrant farm worker. Letta grew up in Nebraska and studied English at the University of Nebraska. While she was there, she met and married psychologist Harry Hollingworth. Leta soon discovered that her husband's field was more interesting than English. So she entered Columbia University, and earned a master's degree in education and sociology, and a Ph.D. in clinical psychology.

As a professional psychologist, Leta Stetter Hollingworth wanted to prove that it was our society's ideas about what was proper for women that kept them from being equal to men, and not a fact of nature as many people believed. One of the ideas that her research helped to prove untrue was that women could not think or function as well when they had their period. Another was that men were naturally more intelligent than women. Leta's husband shared many of her views. Both Leta and Harry Hollingworth were a part of the movement to win for women the right to vote and to participate in governmental affairs.

Proving that women could learn as well as men got Leta Hollingworth interested in how all children learn. In 1926, her research on special school programs for exceptional children was published in her book *Gifted Children*. During her career, Leta Hollingworth wrote several more books about gifted and slow-learning children.

Many things have changed since Leta was a girl. Most people no longer believe that women are not as smart as men. No doubt Dr. Leta Stetter Hollingworth would be pleased to see how much social attitudes toward women and women's roles have changed today.

Olive Clio Hazlett (1890-1974)
Mathematician

Photo courtesy: Univ. of Illinois at Urbana-Champaign

OLIVE C. HAZLETT (1890 - 1974)
Mathematician

Olive Hazlett spent most of her career thinking about numbers and their relationships to each other. You may think that mathematics is all figured out, but it isn't. At universities all over the country, people like Olive Hazlett are still working to understand the complex world of numbers and write about it so that others will understand, too. This kind of work is what Olive Hazlett is most remembered for.

Olive was born in Cincinnati, Ohio, but her family moved to New England when she was young. She attended Radcliffe College, a prominent women's college in Massachusetts. Like many women of her time who were serious about their education, Olive chose a women's college because it offered the most support and opportunity for women students, especially those interested in mathematics and science. As a teacher later in her career, Olive Hazlett was on the faculty of both Bryn Mawr and Mount Holyoke, two other women's colleges in the Northeast. Her work was also supported for a time by a fellowship from Wellesley College, another prominent women's college.

Like Anna Pell Wheeler, Olive Hazlett was honored by the annual publication, *American Men of Science*, by having a star placed by her name. Only three women up to her time had ever received this honor. Olive was recognized because of her research and writing which helped mathematicians understand "hyper-complex numbers." In addition to teaching, Olive Hazlett was very active in professional organizations. She edited the newsletter, and served on the council of the American Mathematical Society. Olive Hazlett was well known among her colleagues, and was considered to be one of the two "most active American women mathematicians of the period." The other was probably Anna Pell Wheeler.

In addition to her teaching and research work, Olive Hazlett enjoyed many outdoor activities such as skiing, skating, and rock and mountain climbing. She was also a skilled photographer and loved to take pictures of natural settings.

Margaret Mead (1901-1978)
Cultural Anthropologist

National Women's History Project

Photo courtesy: Library of Congress

MARGARET MEAD (1901 - 1978)
Anthropologist

When she was ten, Margaret Mead would watch her two younger sisters at play and record their actions in a notebook. Then she would study her notes to look for patterns in their behavior. Margaret wasn't just spying. Her mother was a social scientist, and she had taught Margaret the scientific way to study people. This training was good preparation for Margaret's adult work.

During her lifetime, Dr. Margaret Mead became America's foremost woman anthropologist. She did field work in the islands of the Pacific, taught, lectured and wrote more than 40 books.

When she was 17 years old, Margaret left for Barnard College. There she met two famous anthropologists, Ruth Benedict and Franz Boas. They inspired her with stories of their studies. Margaret Mead continued her schooling at Columbia University. As a graduate student, she took her first field trip to do research on the people who lived on the South Pacific island of Samoa.

With her notebook always nearby, Margaret Mead lived with the Samoan people for nine months. She learned their language, and slept, fished, and cooked as they did. She even learned to weave. When she returned to the United States, she wrote a book about what she had seen, *Coming of Age in Samoa*. It compared the lives of teenagers in Samoa to teenagers in the United States. The book became a bestseller throughout the world.

Margaret Mead often returned to the South Pacific during the next eleven years, studying different cultures and learning seven new languages. She found that "doing what comes naturally" was very different among groups and tribes. She was especially interested in the way children were raised in different cultures. She also noted that the roles of men and women in other cultures were sometimes different than they are here. She thought maybe one day the world would have a global culture which would share beliefs, customs and ways of looking at life.

Mead received medals, awards and honors for her pioneering work in anthropology. For over fifty years, Dr. Margaret Mead was associated with the American Museum of Natural History. Today at the museum, a Hall of the Peoples of the Pacific records her life's work – work that began at age ten with her notebook in hand.

27

28

Barbara McClintock (1902 - 1992)
Geneticist

BEST COPY AVAILABLE

National Women's History Project

Photo courtesy: Cold Spring Harbor Laboratory/Research Archives

BARBARA McCLINTOCK (1902 - 1992)
Geneticist

Dr. Barbara McClintock was a genetics researcher whose work focused on corn genes. Growing fields of corn was so important to her research that she often took her sleeping bag into the fields and spent the night there so she could keep the raccoons from eating the corn.

When she was young, Barbara had to beg her parents to allow her to attend college. In those days, many people thought that college was for boys and not for girls. But finally Barbara's parents decided to let her do what she had her heart set on. In college, Barbara became fascinated with the science of genetics, the way traits are passed from one generation to another. Up until she died in 1992, at age 90, she worked 12 hours a day, six days a week at the Cold Spring Harbor Laboratory on Long Island, New York. She conducted her genetics research there for more than 50 years.

Barbara McClintock was one of the most important geneticists of the twentieth century. She is famous for discovering that some genes move around and change the way traits come out in the next generation. The name "jumping genes" was given to her discovery. She published her first paper on her discovery in 1951, but no one seemed interested.

Years later, in 1983, Barbara McClintock's work finally got the recognition it deserved. McClintock became the first woman to win, on her own, the Nobel Prize in physiology or medicine. A British scientific journal said that her "solitary style of work, total independence of thought and extraordinary record of getting things right have elevated her to a prophet in the eyes of some."

In Barbara McClintock's early years, a woman's work was not valued as much as a man's, no matter how good it was. McClintock was ahead of her time, and some of her fellow scientists did not recognize the significance of her laboratory work. Because she was a loner and a woman, they thought her ideas were crazy, and refused to take her seriously.

Eventually, though, McClintock was recognized as "one of the most important figures in the history of genetics." When she received the Nobel Prize, Dr. Barbara McClintock said, "The only thing I ever wanted was the respect of other scientists. Now, I have it."

Grace Murray Hopper (1906 - 1992)
Mathematician

National Women's History Project

Photo courtesy: Unisys Corporation

GRACE MURRAY HOPPER (1906 - 1992)
Mathematician

As a child at home one summer, Grace Murray took apart seven clocks to see how they worked. Her parents were understanding, but suggested she continue her experiments with just one clock!

Translating her childhood interest into academic achievement, Grace graduated from Vassar College with degrees in mathematics and physics and soon earned her master's degree and Ph.D. in mathematics. While in graduate school she married Vincent Hopper. They divorced in 1945.

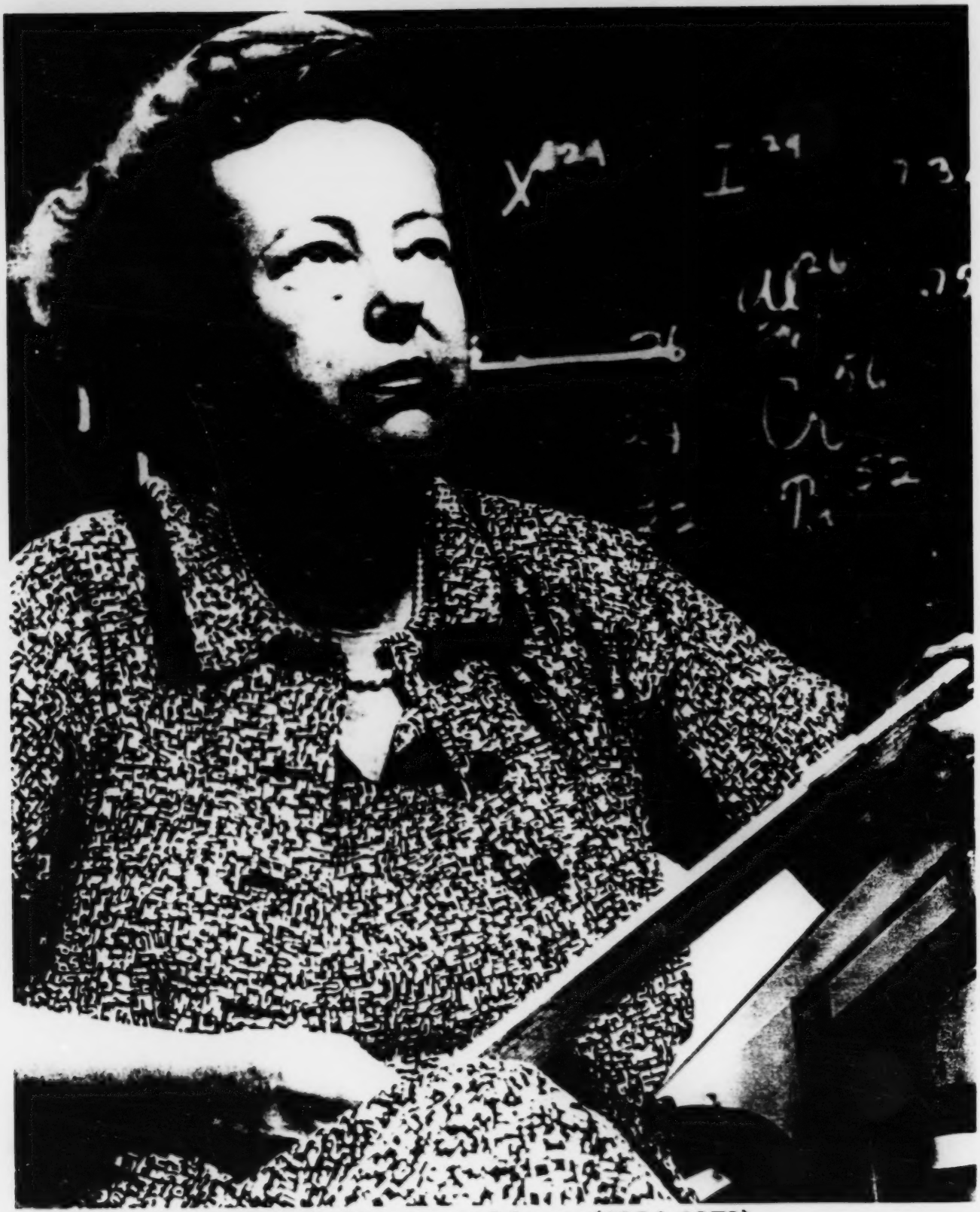
When the United States entered World War II, Grace Hopper joined the Navy. There she saw a "computing engine," which was 51 feet long and had mechanical relays that clattered as they opened and closed. It was called the Mark I, and it was the world's first large-scale digital computer. Grace soon became an expert on this machine.

Once Hopper was asked to, "Have the coefficients for the interpolation of the arc completed by next Thursday," seemingly an impossible task. But she did it, and by mid-1952 she was able to say, "I can make a computer do anything which I can completely define." In those days, making a computer do anything took dedication. Grace Hopper often slept at her desk in case the Mark I needed attention as it clicked away through the night.

As computer development progressed, groups competed to develop a computer language using English-like sentences that would be compatible with equipment from different manufacturers. Dr. Hopper was at the leading edge of this effort. In 1960 she was the first to demonstrate a version of the COmmon Business Oriented Language (COBOL) on two different types of computers.

Dr. Grace Hopper retired from the Navy at age 79 with the rank of Rear Admiral. During her years of service she was often referred to as "Amazing Grace" because of her brilliance and dedication in helping modernize the Navy by standardizing the way it used computers.

"Amazing" also describes the long list of awards, medals and honorary degrees Dr. Grace Hopper received. Her parents may have sacrificed seven clocks, but the girl they encouraged grew up to be a remarkable woman.



Maria Goeppert-Mayer (1906-1972)
Nuclear Physicist

Photo courtesy: Univ. of California, San Diego Archives

MARIA GOEPPERT MAYER (1906 - 1972)
Nuclear Physicist

After she won the 1963 Nobel Prize in physics, Dr. Maria Goeppert Mayer was surprised to realize that "winning the prize wasn't half as exciting as doing the work itself."

But, for Maria, getting an opportunity to do the work wasn't always easy. Her father, grandfather and several great-grandfathers before her had all been college professors. Maria intended to carry on the family tradition. She earned her Ph.D. in theoretical physics when she was only 24 years old. Her work was considered to be excellent. She wanted to teach and continue her research, but she ran into a problem. Maria was married to a college professor, and colleges at that time would not hire both a husband and wife even if both had doctoral degrees.

Maria Goeppert Mayer's husband taught in the chemistry department at Johns Hopkins University. Maria was given a small room in the attic of the science building and allowed to be an assistant and volunteer worker. During this time, though, she did research on her own. She wrote papers on organic compounds, and worked with her husband to write a textbook which became a classic in this field.

After years of working without pay, Mayer took a paid teaching job at Sarah Lawrence College. Then, in 1942, she was asked to work on a secret government research project called "the Manhattan Project." The task was to build an atomic bomb to use as a weapon in World War II. Although Maria Goeppert Mayer had mixed feelings about working on such a project, she welcomed the challenge and excitement. More importantly, she said, "I was suddenly taken seriously, considered a scientist." She was taken so seriously that she became the supervisor of 20 other scientists.

When the war was over, the Mayers went to work at the University of Chicago. Again Maria was not paid because she was married to a professor. Finally, when she was hired as a senior physicist at the Argonne National Laboratory, Dr. Maria Goeppert Mayer received a salary. She worked on the ground-breaking "shell-model" theory, and that exciting work won her the Nobel Prize.

34

35

Rachel Carson (1907-1962)
Marine Biologist, Author

National Women's History Project

Photo courtesy: Yale University Beineke Library

RACHEL CARSON (1907 - 1964)
Marine Biologist, Author

In 1957 Rachel Carson received a disturbing letter from a friend. A government plane had sprayed her friend's property with an insecticide, DDT, killing seven songbirds instantly. More birds were found dead the next morning. As a marine biologist interested in "the whole world of nature," Rachel had suspected that such use of pesticides endangered not only her friend's bird sanctuary but all living things.

Rachel Carson began her career at the Marine Biological Laboratory at Woods Hole, Massachusetts. She was one of the first women hired as an aquatic biologist by the U.S. Bureau of Fisheries. Writing was a large part of her work. She wrote bulletins on seafood, and booklets on wildlife refuges. She also wrote a book, *The Sea Around Us*, which stayed on the best-seller list for 86 weeks. Her book earned her the National Book Award and was eventually published in 32 languages.

When Rachel Carson read her friend's letter, she decided to do a scientific analysis of DDT. Even though the government said DDT was "entirely harmless," she suspected it was not. And, if she was right, she knew she could write an interesting and important account of her findings.

Four years later, Rachel Carson's book, *Silent Spring*, proved that DDT and many other chemical insecticides dangerously threatened the balance of all life. Her book was read and discussed throughout the world. But both the government and the chemical industry (which saw a threat to its profits) attacked Carson, calling her work "good poetry but poor science." In the end, scientists and the President's Science Advisory Committee supported Rachel Carson's findings, and DDT was banned in the United States in 1972.

Rachel Carson used her writing skills and knowledge as a scientist to alert the world to the need to protect all living things. She said, "I could never again listen happily to a thrush song if I had not done all I could." Today, *Silent Spring* is recognized as one of the influences that sparked the worldwide interest in ecology. And Rachel Carson is recognized as a hero for helping us to understand the relationship between all living things.

Rita Levi-Montalcini (b. 1909)
Biologist

Photo courtesy: Washington University, St. Louis, Missouri

RITA LEVI-MONTALCINI (b. 1909)
Biologist

"One doesn't lose heart in the face of the first difficulties," a friend once told Dr. Rita Levi-Montalcini.

Problems weren't new to Rita. She remembers having to plead with her traditional Italian father to be allowed to attend the medical school where she later graduated with top honors.

But the "difficulties" her friend spoke of were much greater. Because she was Jewish, Rita was forbidden to work as a doctor, to do medical research, to attend lectures or even to use the library. It was the beginning of World War II, and Italy was partners with Germany. Hitler, Germany's Nazi dictator, hated the Jews. Many laws were passed in both countries restricting the lives and work of Jewish people.

Rita was forced to conduct her research in secret. She set up a small laboratory in her bedroom. Only her family and a few trusted friends knew she was beginning to explore "the jungle" of the nervous system.

In the early 1940s, Hitler's armies were invading Europe, and the world was becoming a frightening place. But Rita and her assistant, Guiseppe Levi, continued to peer into their microscopes and write their research notes. But, before the war ended, Rita was forced to flee for her life to Florence, Italy, using a false name. She hid there until the British forces arrived in 1944.

In 1946, she accepted an invitation to continue her research in the United States. At Washington University in St. Louis, Missouri, Dr. Rita Levi-Montalcini helped discover the nerve growth factor (NGF), a substance in the body that causes cells to grow. Further research in this area has led to a better understanding of cancer cells, and may eventually lead to treatments for diseases like alzheimer's and Parkinson's.

But new "difficulties" arose. Other researchers repeated Levi-Montalcini's NGF experiments without giving her credit, and she later recalled, "My name was entirely left out of the literature." However, Rita Levi-Montalcini was not left out in 1986 when the Nobel Prize in Physiology and Medicine was awarded to her and her colleague, Stanley Cohen. Today NGF research is conducted worldwide. The ability to triumph over "difficulties," Dr. Levi-Montalcini believes, is one key to her success.

Chien-Shiung Wu (b. 1912)
Nuclear Physicist

Photo courtesy: AIP Niels Bohr Library

CHIEN-SHIUNG WU (b. 1912)
Nuclear Physicist

Born in China, Chien-Shiung Wu came to the United States as a teenager and stayed to become "the queen of nuclear physics." She won many awards for her work, including the National Science Medal in 1975 and the internationally respected Wolf Prize in 1978.

As a graduate student at the University of California, Berkeley, Chien-Shiung Wu was fortunate to study with the 1939 Nobel Prize winner in physics, Ernest O. Lawrence. Wu was an excellent student and was elected to Phi Beta Kappa, the honors society.

Chien-Shiung Wu earned her Ph.D. in 1940, and then taught at Smith College and Princeton University. She became known as "the world's foremost female experimental physicist."

In 1944, Dr. Wu moved on to Columbia University, and was eventually made a full professor of physics. At Columbia her research was on the emission of electrons from the atomic nuclei of radioactive substances. Her most famous experiment disproved what had been considered a fundamental law. This "law" was the "conservation of parity," which asserted that all processes in nature take place in the same way as if the whole setup (right down to microscopic details) were mirror reversed.

In Chien-Shiung Wu's experiment, the emission process distinguished between a left-corkscrew and a right-corkscrew configuration. Dr. Wu's tremendous reputation for accuracy contributed to the scientific community's immediate acceptance of this revolutionary result.

Because of her important research, Dr. Wu was given a great honor. In 1958 she became the first woman ever to receive the Research Corporation Award, an honor given each year to an outstanding scientist. In her acceptance speech, Dr. Wu remarked that it was probably the first time that the award was given "not for establishing a law, but for overthrowing it."

Dr. Chien-Shiung Wu has said, "Science is not static but ever-growing and dynamic...It is the courage to doubt what has long been established, the incessant search for its verification and proof that pushed the wheel of science forward."

41

Gertrude B. Elion (b. 1918)
Pharmacologist

42

National Women's History Project

Photo courtesy: Burroughs Wellcome Company

GERTRUDE B. ELION (b. 1918)
Pharmacologist

Since she lost her beloved grandfather to cancer when she was fifteen years old, Gertrude Elion was determined to do cancer research. Maybe she would be the one to find the cure for this terrible disease that kills so many people! She studied chemistry at Hunter College in New York City, and graduated with high honors when she was only 19 years old. But even with such an outstanding academic record, Gertrude's application to graduate school was turned down by fifteen different schools – because she was a woman.

Eventually Gertrude Elion was accepted into graduate school, and she earned a master's degree from New York University. But when she started looking for a job, she ran into the same kind of discrimination. Laboratory after laboratory turned her down because she was too young and "cute." But when World War II began, so many men were called to military duty that jobs of every kind became available to women. Gertrude Elion was finally hired by Johnson and Johnson. In 1944 she took a lab assistant position at Burroughs Wellcome, and threw herself into the work with great excitement and enthusiasm.

Gertrude Elion has spent most of her life doing research to develop drugs that can be used to treat life-threatening diseases. Her work has been useful in the fight against herpes, cancer, and leukemia, and in making kidney transplants and chemotherapy easier for the human body to tolerate. Elion's work has been so important that in 1989 she was awarded the Nobel Prize in Medicine, along with her partner, George Hitchings. Elion received a medal of honor from the American Cancer Society in 1990, and in 1991 she became the first woman inducted into the National Inventors Hall of Fame – just a few of the many honors and awards she has earned during her career.

Gertrude Elion will always remember the discrimination she faced when she was young. She says, "Maybe I was young and 'cute' (after all, I was only twenty then), but I've learned over the years that when you put white lab coats on chemists, they all look alike! Believe me, when I later reached a position where I did the hiring, I never took looks into consideration." Elion is pleased with the message that her honors and position have given to other women who might be interested in a career in science. If science is your calling: You can do it!

Rosalyn Sussman Yalow (b. 1921)
Research Nuclear Physicist

National Women's History Project

Photo courtesy: Medical Media Production Service

ROSALYN SUSSMAN YALOW (b. 1921)
Research Nuclear Physicist

Before she was old enough to go to school, Rosalyn Sussman had a favorite place. It was her neighborhood library in the Bronx, New York. And, after she started school, she had a favorite subject – science. She was glad she loved science because she wanted to be good in something, and, as she recalls, "I wasn't an athlete, I couldn't draw, and I couldn't carry a tune."

Rosalyn's parents encouraged her to follow her interest in science. But they didn't have enough money to send her to a major university. So Rosalyn enrolled at Hunter College which was nearby and free. When she graduated with honors in 1941, she set her sights on studying nuclear physics in graduate school.

At that time it was so difficult for a woman to get into a graduate program in physics that Rosalyn had to take a job as a secretary to support herself while she was trying to get accepted. Rosalyn didn't give up, though. On the day she was finally accepted by the University of Illinois, she tore up her secretary's book. As the first female teaching assistant in the physics department in 25 years, she was the only woman among 400 male faculty members. But four years later, she had earned her Ph.D. in nuclear physics.

Rosalyn married a young scientist, Aaron Yalow, and felt fortunate that "he accepted the fact that I wanted a successful career."

In 1977 Rosalyn Sussman Yalow became the first American-trained woman to win a Nobel Prize in any of the sciences. Rosalyn Yalow has won so many honors, awards and prizes for her scientific work that a list of them all would continue for pages. But winning the Nobel Prize had a special meaning for her. Today, Rosalyn Yalow is well known for her work as a senior medical investigator at the Bronx Veterans' Administration Hospital.

Perhaps remembering her own childhood trips to the library, Dr. Rosalyn Sussman Yalow believes that young people should begin thinking about their careers as early as possible. She says, "You can't all win Nobel Prizes, but the important thing is to set goals for yourself and live up to them."

Jewel Plummer Cobb (b. 1924)
Biologist

National Women's History Project

Photo courtesy: Dr. Jewel Plummer Cobb

JEWEL PLUMMER COBB (b. 1924)
Biologist, Administrator

Jewel Plummer peered into a microscope in Ms. Hyman's sophomore biology class. Through it she saw "an entirely new world," and was inspired to take her first step toward a career in science. That career has led to numerous honors by associations, universities and professional organizations.

There were both positive and negative influences in Jewel's early life. Her father was a physician and supported her interest in science. In high school and at the University of Michigan, however, Jewel experienced the prejudice openly shown against African Americans at that time. She transferred to Talladega, a Black college in Alabama where she felt more comfortable, and finished her degree. She went on to earn a master's degree and a doctorate in cell physiology from New York University.

Jewel Plummer began her professional career with a fellowship from the National Cancer Institute. The funding made it possible for her to begin a research project at Harlem Hospital Cancer Research Foundation to design new experiments to aid in the treatment of cancer. In 1952, the Institute awarded her a research grant that would finance her work for the next 24 years.

A few years later she married, and, as Jewel Plummer Cobb, she returned to the Harlem hospital to begin an exciting phase of the basic cell research that has made her world famous. She has written more than 50 books, articles and scholarly reports in her specialized field.

Cobb's career in education and administration has been as distinguished as her career in research. She worked as an instructor, professor, director, dean and president at a number of leading colleges and universities and has been awarded sixteen honorary doctoral degrees.

Now retired from her position as president of California State University at Fullerton, Dr. Jewel Plummer Cobb still works to inspire students in the African-American community. She says her goals for the future include "...vigorous involvement with nationwide programs to enhance the academic preparation and academic enthusiasm for science and technology among Black junior high and senior high school students."

Dian Fossey (1932-1985)
Primatologist

Photo courtesy: The Digit Fund, Englewood, Colorado

DIAN FOSSEY (1932 - 1985)
Primatologist

When the shy mountain gorilla, Digit, approached Dian Fossey and touched her hair, Fossey knew that touch was his gift of friendship. She wished she could give Digit and the other gorillas, something as special in return.

Dian Fossey was studying to be an occupational therapist at San Jose State University in California. But when she met the well-known anthropologist Dr. Louis Leakey, she decided to study primates instead. Dian wrote an article about the gorillas, and when Dr. Leakey read it, he offered to get funding for Dian to study the gorillas and report on their behavior.

To do her research on the gorillas, Dian Fossey had to move to the high mountains of Rwanda in Africa. She lived and worked there for 18 years. She studied the gorillas, making friends with them and trying to protect them from poachers who wanted to kill the animals and sell their bodies.

Dian Fossey's work earned her a Ph.D. in Zoology from Cambridge University. Her book, *Gorillas in the Mist*, was published in 1983, and became popular throughout the world. Books, articles, and even a Hollywood movie have tried to tell the story of "the woman who lives alone in the forest," as she was called by the Rwandan people. But the stories are sometimes different from each other because some people liked Dian Fossey and some did not. She retaliated against the poachers in ways that seemed out of keeping with her gentle regard for the mountain gorillas, and her colleagues were often disturbed by her actions. In 1985 Dian Fossey was mysteriously murdered.

But there was no disagreement about Dian Fossey's loving Digit, Uncle Bert, and their gorilla families. She not only named them all but also made friends with them, knew their personalities and watched them live out their stages of life: birth, youth, maturity and death.

The wish that Dian Fossey made when Digit first touched her did come true. She gave the gorillas the gift of world attention to their plight, and an increased chance for survival.

Reatha Clark King (b. 1938)
Chemist, Administrator

Photo courtesy: Dr. Reatha Clark King

REATHA CLARK KING (b. 1938)
Chemist, Administrator

Reatha Clark King grew up in a sharecropper family in rural Georgia. Even as a child she felt that she had a trust to uphold. Everyone in her community believed that getting an education could lead to a better life for young African Americans. Her parents, neighbors, teachers and church leaders all encouraged Reatha to use her brain and "make something of yourself." And she did just that! Today, after excelling in chemical research, education and academic administration, Dr. Reatha Clark King is vice-president of General Mills, Inc., and executive director of the General Mills Foundation.

When Reatha started college, she thought she wanted to become a home economics teacher. But as she began to learn about other career possibilities, she changed her major to chemistry. She found the laboratory and lecture sessions exciting and challenging, and her fellow students serious and fun. She went on to the University of Chicago, earning a Ph.D. in 1963.

Reatha's first job at the National Bureau of Standards required that her work be "of the highest quality possible." She learned how to pay careful attention to details, and took the good work habits she learned there to her later position as president of Metropolitan State University. Reatha Clark King has said, "My feeling of pride about the quality of my scientific work has strengthened my ability to function in other careers."

Carrying her enthusiasm over to her present job as a foundation executive, King says, "Each day of my work is unique and exciting." She knows that people expect a lot of her and trust her to do the right thing, and she enjoys having this "special trust to uphold."

As busy as Reatha Clark King has been throughout her 25 years as a chemist, college professor, administrator, university president and foundation executive, she has always made community service part of her daily routine. Sometimes this service has taken her to other countries, such as Japan, Israel, the Philippines, Tanzania, India and Bangladesh.

"Leadership can be lonely at times," Dr. Reatha Clark King quickly admits. But she credits her family – her husband, Dr. N. Judge King, their two sons and her parents – with giving her strength and optimism. The woman who "made something of herself" continues to uphold the trust of her community.

53

Shirley A. Jackson (b. 1946)
Theoretical Physicist

54

National Women's History Project

Photo courtesy: AT&T Archives

SHIRLEY A. JACKSON (b. 1946)
Theoretical Physicist

As a young Black woman attending the Massachusetts Institute of Technology, Shirley Jackson didn't see many other women or African Americans on campus. Sometimes she asked herself, "Should I really be doing this?"

Shirley's high school teachers thought she should. Her parents thought so, too. Her mother had read ten-year-old Shirley books about successful African Americans, and her father had set aside a corner of the family kitchen just for her science projects.

When the Russians launched the first satellite in 1957, Shirley was very excited. Her interest in space launched her on her way to becoming one of today's "superstars of science."

Shirley Jackson was the first African-American woman to earn a Ph.D. in physics from the Massachusetts Institute of Technology (MIT). But, as a student, Shirley felt isolated. Prejudice against African Americans deprived her of some of the social experiences most students enjoy. This experience led her to help organize MIT's Black Student Union. She hoped this organization would influence the school to accept more minority students and provide financial help for their education.

From MIT Shirley Jackson went to work as a research associate at the Fermi National Accelerator Laboratory and then as a visiting scientist at the European Organization for Nuclear Research in Geneva, Switzerland. In 1982 she was a lecturer at the NATO International Advanced Study Institute in Antwerp, Belgium.

Today Shirley Jackson works as a physicist at the famous AT&T Bell Laboratories in New Jersey, where she studies questions about the nature of matter and how it behaves. Her research has brought her international recognition. In addition, Jackson teaches at MIT, is a professor of physics at Rutgers University and is active in organizations promoting women in science. She was elected as a fellow of the American Physical Society and the American Academy of Arts and Sciences, and has received many other awards and honors.

Should Dr. Shirley Jackson really be doing this? The answer from the world of science is a definite "Yes!"

Lydia Villa Komaroff (b. 1947)

Photo courtesy Lydia Villa Komaroff

LYDIA VILLA-KOMAROFF (b. 1947)
Molecular Biologist

"When I'm working hard," says Dr. Lydia Villa-Komaroff, "it is the equivalent of playing hard. It's all the same." Today Lydia Villa-Komaroff is associate professor in the Department of Neurology at Children's Hospital and Harvard Medical School in Boston. She is looking for answers to this question: How do you get from a single cell to a completely organized, functional thing like a human being in just nine months?

When Lydia was growing up in Santa Fe, New Mexico, her mother encouraged her interest in science. But some of her more traditional Mexican-American relatives often asked, "Why are you, a daughter, going to college when you are needed at home?" Later a college counselor told her, "Women do not belong in chemistry." Fortunately, even as a girl Lydia believed both in herself and in the scientific principle that "Things must be questioned as some rules can be wrong."

Lydia Villa-Komaroff earned a degree in biology from Goucher College in Maryland in 1970. She went on to earn her Ph.D. from the Massachusetts Institute of Technology (MIT) in Cambridge, MA. Later she returned to MIT, and joined a team that cloned insulin in bacterial cells. This important work was later described in a book, *Invisible Frontiers: The Race to Clone the Insulin Gene.*

Much of the work Dr. Lydia Villa-Komaroff did at MIT focused on DNA research. DNA is the basic structure of life. This kind of research was controversial, because cloning was like creating life. At one point, the city council of Cambridge passed a law making it illegal to do the kind of DNA research Villa-Komaroff had chosen. Later the ban was lifted, but many rules about what researchers could and could not do have remained.

Dr. Lydia Villa-Komaroff is still finding fun in her job and hopes that young people will realize that hard work can be very satisfying. "They are needed to follow up on work scientists are doing today," she says. "We need talented minds thinking about these problems."

Edna Lee Paisano (b. 1948)

EDNA LEE PAISANO (b. 1948)
Statistician

While she was growing up on the Nez Perce Indian Reservation in Idaho, Edna Lee Paisano used her skill in mathematics to help her father raise quarter horses and Hereford cattle. She delighted in figuring out how many bales of hay would be needed to feed the animals through the winter and how much gasoline the truck would use when she and her father took the cattle out to summer pasture.

Edna also made up number games when she helped with housework. And, when her grandmother made moccasins, Edna would figure out precisely how much deer or elk hide she would need. As an adult, Paisano has been able to extend this help to include all American Indians as well as Alaskan Natives.

Edna attended Boise College and the University of Washington. She studied sociology, earning a bachelor's degree and then a master's degree in social work. She began working in the Indian and Migrants Programs Division of the Office of Child Development. Later she worked as a consultant helping to develop educational material about American Indians. Edna also helped those who ran the Indian tribal governments learn the best ways to organize and manage their many activities.

In 1976 Edna Lee Paisano went to Washington, D.C., to work for the Census Bureau. She knew it was important to have someone like herself there to interpret the data gathered from the census. Because she grew up on a reservation she knew she could really understand Indian people's needs and lifestyles.

Paisano's first assignment was to construct a special questionnaire to gather information about the living conditions of American Indians and Alaskan Native people. The questions she asked were important because the answers would be used by tribal governments to determine needs and to plan for the future. Paisano has continued to work on many such projects since then.

Edna Lee Paisano's life has been profiled in a number of publications about women in mathematics. She has truly found a way to put her love of mathematics together with her concern for her people.

Constance Tom Noguchi (b. 1948)

Photo courtesy Constance Tom Noguchi

CONSTANCE TOM NOGUCHI (b. 1948)
Physical Biochemist

When Constance Tom was growing up in San Francisco, she saved the seeds from the fruits and vegetables her family ate. She loved to plant the seeds to discover what shape and color the new leaves would be. She didn't know then that her curiosity would lead her to a career in science. While Constance was in junior high, an after-school program introduced her to other branches of science. She learned about reptiles, birds, and a new type of machine – a computer.

Constance attended the University of California at Berkeley, where she met Phil Noguchi. After they married, the couple moved to Washington, D.C. Constance Tom Noguchi studied theoretical nuclear physics at George Washington University, and received her Ph.D. in 1975.

The excellent work habits Constance Tom Noguchi learned while conducting her scientific studies were carried over to her work at the National Institutes of Health in Bethesda, Maryland. There she pursued a new interest and began conducting biomedical research. Most recently, she has been working on the causes and possible cures for sickle-cell anemia, a blood disorder that is especially common among African Americans. Noguchi's work has helped doctors understand this disease and how it affects their patients. She hopes it will also lead to new ways to treat it.

Noguchi often takes time to meet with the students who visit the National Institutes of Health. She remembers how her own exposure to science as a girl motivated her to keep learning. She meets with the students who are finalists in the Westinghouse Science Talent Search. Each summer she also chooses several high school, college and medical students to work with her in her laboratory. This helps the students gain professional experience and lays valuable groundwork for their own careers in science.

Maybe Dr. Constance Tom Noguchi works with these students because she recalls the saying, "As the twig is bent, so grows the tree." Maybe she remembers, too, those little shoots coming up from the seeds she nurtured as a child.

Judith Resnik (1949-1986)
Electrical Engineer, Astronaut

Photo courtesy: National Aeronautics and Space Administration

Books about Women in Science and Mathematics

Upper Elementary to Secondary

*** The Scientist Within You: Experiments and Biographies of Distinguished Women in Science**
Rebecca Lowe Warren & Mary H. Thompson. Grades 3-9. Eugene, OR: ACI Publishing, 1994.

*** Women Inventors Magazine**
Grades 4-8. Peterboro, NH: Cobblestone, 1994.

*** Women in Astronomy Magazine**
Grades 4-8. Peterboro, NH: Cobblestone, 1994.

*** From Indian Corn to Outer Space: Women Invent in America**
Ellen H. Showell & Fred M.B. Amram. Grades 4-9. Peterboro, NH: Cobblestone, 1995.

*** The Scientist Within You: Women Scientists From Seven Continents – Biographies and Activities**
Rebecca Lowe Warren & Mary H. Thompson. Grades 5-10. Eugene, OR: ACI Publishing, 1995.

*** Women and Numbers**
Teri Perl. Grades 5-12. San Carlos, CA: Wide World Publishing, 1993.

Secondary to Adult

*** American Women in Science: A Biographical Dictionary**
Martha J. Bailey. Grades 7-Adult. Santa Barbara, CA: 1994.

*** Women Scientists**
Nancy Veglahn. Grades 8-12. Newark, NJ: Facts On File, 1991.

*** Women in Space: Reaching the Last Frontier**
Carole S. Briggs. Grades 7-12. Minneapolis: Lerner, 1988.

*** Contemporary Women Scientists**
Lisa Yount. Grades 8-12. Newark, NJ: Facts On File, 1994.

*** Math Equals: Biographies of Women Mathematicians**
Teri Perl. Grades 9-12. Reading City, MA: Addison-Wesley, 1978.

*** Women in Mathematics**
Lynn M. Osen. Grades 9-Adult. Cambridge: Massachusetts Institute of Technology Press, 1974.

*** Nobel Prize Women in Science**
Sharon Bertsch McGrayne. Grades 9-Adult. NY: Carol Communications, 1993.

Women in Science: Antiquity Through the Nineteenth Century: A Biographical Dictionary
Marilyn Bailey Ogilvie. Grades 9-Adult. Cambridge: Massachusetts Institute of Technology Press, 1986.

*** Women of Science: Righting the Record**
G. Kass-Simon & Patricia Farnes, eds. Grades 9-Adult. Bloomington: Indiana University Press, 1990.

*** Feminine Ingenuity: How Women Inventors Changed America**
Anne L. Macdonald. Grades 10-Adult. Westminster, MD: Random House, 1992.

Titles marked with an asterisk (*) are available through the NWHP's Women's History Catalog as of Fall 1995. For a free copy of the current catalog write to: Catalog Request, NWHP, 7738 Bell Road, Dept. MAT, Windsor, CA 95492. Or call 707-838-6000.

JUDITH RESNIK (1949 - 1986)
Electrical Engineer, Astronaut

When Judith Resnik was chosen to be an astronaut in 1978, she was interviewed by television, radio and magazine reporters. One asked her, "Are you up to the rigorous training you'll receive at the Johnson Space Center in Houston?" Her answer was, "The important thing is dedication. I believe I'm qualified to do whatever NASA calls on me to do, and I believe the other men and women chosen feel the same way." To another reporter she said, "There is a lot to learn from space and a lot to learn about the earth from space. I'm eager to get started."

Judith Resnik's talent and interests showed early in her life. As a child, she spent many hours studying the exhibits in the National Air and Space Museum in Washington, D.C. She earned her Ph.D. in electrical engineering at the University of Maryland, and later worked as an engineer at RCA and as a biomedical researcher at the National Institutes of Health.

Judith was working for the Xerox Corporation when NASA chose her from among hundreds of applicants to become a mission specialist. Mission specialists are the astronauts who perform experiments, do space walks, deploy satellites, and do all the "housekeeping" tasks on board the space shuttle. Although she never actually flew the space shuttle, Judith Resnik did know how to fly.. She had earned a pilot's license before joining NASA, with almost perfect scores on her tests. Some of Judith's duties with NASA were on the ground. For example, she worked with Dr. Sally Ride to test the remote manipulator system, a mechanical arm that is used to perform tasks in space.

Judith Resnik became the second American woman to fly in space when she took part in the six-day Discovery mission. Once when she was being photographed on board, she held up an unofficial sign that was beamed back to television screens on earth. It said, "Hi, Dad!"

Judith Resnik was killed tragically, along with six other astronauts, when the space shuttle *Challenger* exploded upon takeoff in 1986. Despite this great loss, Dr. Judith Resnik's dedication has set an example that will keep the aspirations of many young women and men alive for years to come.

National Women's History Project

This booklet is one of the many types of curriculum materials developed by the National Women's History Project for use at various grade levels. Our Project's mission is to promote gender equity through public recognition of women's diverse lives and accomplishments. We are delighted with the public response to our efforts.

National Women's History Month, originated by members of this Project, has become a regular feature on school, workplace and community calendars. It is our goal to eventually have the study of women's history included as a regular part of the K-12 curriculum, so that students and adults alike can celebrate the tremendous contributions of women from all walks of life.

The Women's History Catalog has grown dramatically since its inception in 1983. The 48-page catalog offers a plethora of books, curriculum units, posters, games, plays, and videos on women in all areas of life, and for all ages.

The Women's History Network, coordinated out of our office, includes hundreds of individual and institutional participants working together across the country to write women back into history. A quarterly newsletter keeps current information in circulation; directories make each participant accessible to the others.

The NWHP consulting staff conducts in-service training workshops for school districts and state departments of education throughout the country. Our four-day women's history training workshops, held each summer in California, draw educators and community activists from across the nation.

Continued expansion of our services is a necessary part of our plan for financial self-sufficiency. We are a non-profit, educational corporation; your donations above the price of the items ordered are tax deductible, and will greatly facilitate our ongoing work.

It is our hope that the services and materials we offer will be a useful resource and support for your efforts to write women back into history.

The National Women's History Project Staff